

Received Date : 18-Oct-2013

Revision requested: 12-Nov-2013

Accepted Date : 16-Jan-2014

Article type : Letter to the Editor

Infrarenal origin of the superior mesenteric artery challenges the procurement surgeon

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designed the paper	x	x	x	x
reviewed literature	x	x	x	x
collected data	x			x
wrote the paper	x	x	x	x

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/tri.12271

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contributed	important	x	x	x	x
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Acknowledgements

No funding was provided for this study.

Conflict of interest statement

None declared.

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Running title

Infrarenal origin of the superior mesenteric artery

Key-words:

Procurement – anatomy – renal artery – superior mesenteric artery

Abbreviations

RA: Renal Artery

SMA: Superior Mesenteric Artery

Dear Sirs,

With this Letter we would like to draw attention to the importance of complete identification of both renal arteries (RA) and superior mesenteric artery (SMA) during a procurement procedure. Usually the RAs originate from the aorta below the level of the SMA. However, when a polar or hilar RA originates above the SMA, accidentally cutting a RA can easily remain unnoticed.

During a multi-organ procurement in a 55-year old female donor, an aberrant anatomy of SMA and RAs was found. After a standard sterno-laparotomy, general inspection, exclusion of accessory hepatic arteries, a Cattell-Braasch manoeuvre, and flushing of the bile duct, the aorta and vena cava were cannulated. After cold flush with University of Wisconsin solution, the liver-pancreas bloc was split from

the kidneys. Both RAs arose cranial to the SMA (**Figure 1, Panel A**). As the pancreas was not allocated and there was no right accessory hepatic artery, the origin of the SMA was left with the renal bloc in order to preserve sufficient renal aortic patches. Splitting of both kidneys at the back table revealed two hilar RAs for each kidney. Both had the same diameter (4 mm) and originated cranial and caudal to the SMA. The distance between the two arteries was two centimetres on both sides. Both kidneys were transplanted successfully.

During embryologic development, the kidneys and their vasculature move cranial into their definitive position at the level of the first and second lumbar intervertebral disc (1-3). The SMA originates 1.0-1.5 cm higher, at the lower third of the first lumbar vertebra (1, 4-6). The right RA emerges cranial to the left RA in 50%-72% of cases (1, 3). Despite the variability in the position of the RAs origin, hilar RAs have been reported to arise at levels above the SMA (7). According to an anatomical study of 298 cadavers, the incidence of a RA arising at the same level of the SMA is 3.5 %. None arose distinctively above the level of the SMA (1). Accidentally cutting a RA because of this unusually high origin is not unthinkable but can easily be avoided by identifying the origin of both RAs and SMA.

Most of the time, the aorta can be cut just caudal from the SMA without damaging the RAs and leaving a sufficient patch for SMA and RAs (**Figure 1, Panel B**). However, when a polar or hilar RA originates above the SMA, the aorta should be divided cranial to the ostia of the RAs. Consequently, the origin of the SMA will stay with the kidney bloc. When the pancreas is allocated as a vascularized graft, aortic patches for both kidneys and pancreas should preferentially be preserved. If this is not possible, the RAs can be procured without aortic patch, leaving a sufficient patch on the SMA for the pancreas. Alternatively, the SMA can be cut as close as possible to the aorta providing sufficient length for vascular reconstruction

and leaving aortic patches with the kidneys. In case of unusual arterial anatomy, it is best to contact the recipient centers to provide them with information on how the pancreas was split from the kidneys.

References

- 1 Cauldwell EW, Anson BJ. The visceral branches of the abdominal aorta: topographical relationships. *Am J Anat* 1943; 73(1): 27-57.
- 2 Parrott TS, Skandalakis JE, Gray SW. The kidney and ureter. In: *Embryology for Surgeons*. 2nd ed. Baltimore, MD: Williams & Wilkins; 1994: 594-670.
- 3 Beregi JP, Mauroy B, Willoteaux S, Mounier-Vehier C, Rémy-Jardin M, Francke JP. Anatomic variation in the origin of the main renal arteries: spiral CTA evaluation. *Eur Radiol* 1999; 9: 1330-1334.
- 4 Ozan H, Alemdaroglu A, Sinav A, Gümüşalan Y. Location of the ostia of the renal arteries in the aorta. *Surg Radiol Anat* 1997; 19: 245-247.
- 5 Pennington N, Soames RW. The anterior visceral branches of the abdominal aorta and their relationship to the renal arteries. *Surg Radiol Anat* 2005; 27(5): 395-403.
- 6 Kosinski H. Variability of places of origin of the human renal arteries. *Folia Morphol* 1994; 53(2): 111-116.
- 7 Rushton FW, Roy WA, Mitchell ME. Infrarenal origin of the superior mesenteric artery: implications in endovascular repair of abdominal aortic aneurysm. *Vasc Endovascular Surg* 2010; 44(8): 680-682.

Figure Legend

Figure 1

Panel A

Peroperative view of the donor abdominal aorta at the level of the renal arteries.

The ostia of the right (rRA) and left renal artery (lRA) are situated on the lateral side of the abdominal aorta, cranial to the origin of the superior mesenteric artery (SMA).

H, Head; F, Feet; R, Right; L, Left

Panel B

Anatomical sketch to illustrate the separation of the aorta at the level of the superior mesenteric artery (SMA) and renal arteries (RAs) in a normal anatomical situation.

In case of pancreas and kidney allocation, the aorta should be cut caudal to the origin of the SMA, preserving sufficient arterial patches for SMA and both RAs.

